Methods and Fidelity of Smarter Lunchrooms Program to Decrease Plate Waste in Children's School Lunch Meal

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Abstract

Obesity is the most common chronic disease among children. National School Lunch Program (NSLP) plate waste may contribute to caloric overconsumption as students compensate for wasted calories by selecting energy-dense, nutrient-deficient alternatives. The purpose of this study was to develop and implement Smarter Lunchrooms (SL) programming in Ohio to promote healthier food selection and lessen plate waste among children participating in the NSLP. SL was a pre-post intervention trial targeting school-aged children at a convenience sample of 12 schools (mostly grades K-5). Rooted in behavioral economics theory, SL employs multi-component interventions individualized to each school. Trained researchers conducted pre- and post-analysis of SL practices at each school using a standardized tool, developed by the Cornell Center for Behavioral Economics in Child Nutrition Programs, in which researchers rate (0-5) the level of SL practices across five categories (Fruit, Vegetable, White Milk, Target Entrée, and Reimbursable Meal) for a possible total of 25 points. Scores were averaged (mean$\pm$SD) across schools and categories. Process evaluations were completed at a subset of schools weekly for 3 weeks post-intervention to determine fidelity of program implementation. SL practice scores increased from 7.4$\pm$3.3 pre-intervention to 13.8$\pm$2.3 post-intervention. All categories showed improvement post-intervention with the largest advancement in Fruit (+3.3) and Vegetable (+1.5) practices. Process evaluation data showed 69% compliance overall. Compliance was lowest for SL strategies of increasing the number of locations fruit is offered (55%), labeling fruit (44%) and targeted entrée (17%) with creative, age-appropriate names, and offering equal amounts of white and chocolate milk (38%). These results demonstrate SL programming was developed and implemented across Ohio schools with moderate implementation fidelity. Future research is needed to evaluate factors related to the fidelity and development of effective tactics to improve programming fidelity.

Background

Childhood obesity in the United States has more than doubled in children and tripled in adolescents in the past 30 years. Childhood obesity is the most common chronic disease of childhood, with more than one third of U.S. children and adolescents overweight or obese (Ogden, Carroll, Kit & Flegal, 2014). Childhood obesity has immediate effects on health including increased risk for high cholesterol and high blood pressure, which increase risk for cardiovascular disease (Ogden, Carroll, Kit & Flegal, 2014). Compared to non-obese peers, obese adolescents are more likely to have pre-diabetes, bone or joint problems, sleep apnea, and social and psychological problems (Daniels, 2005). Costs of treating the effects of obesity are more likely to outweigh the cost of prevention. Children who are obese are 70% more likely to carry obesity into

adulthood (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007). Addressing the issue through obesity prevention in children can prevent children from becoming obese adults and lessening risk for obesity-related diseases and conditions.

There are many genetic, behavioral, and environmental factors that can contribute to childhood obesity. The environment alone can influence food choices in many ways, and society today has created the type of environment that has a tendency to steer people towards less healthy decisions. More than half of U.S. middle and high schools offer sugary drinks and less healthy foods; these foods compete with more healthy food options offered through the NSLP (Ogden, Carroll, Kit & Flegal, 2014). Advertising of less healthy foods can also impact the choices made by children at lunch, whether it be in the media, at home, or in the cafeteria.

The National School Lunch Program (NSLP) is a federally funded program designed to provide financial assistance to schools offering meals that are required to meet nutritional standards based on the Dietary Guidelines for Americans (Fns.usda.gov). More than 31 million children are fed by the NSLP each school day (Fns.usda.gov), making it an excellent target to combat childhood obesity. Even though schools that participate in the NSLP are required to meet specific nutrient standards, they still have the issue of dealing with less healthy competitive foods that are offered along side the reimbursable meal. The NSLP restricts frequency of popular but less healthful foods and increases frequency of a more nutrient rich selection. Restricting popular foods can result in reactance and avoidance behaviors by the students, and can leave foods provided by NSLP left uneaten, leaving the child in an energy deficit. When there is an energy deficit as a result from plate waste, children are more likely to over compensate with energy dense, nutrient deficient foods. Furthermore, when students choose the competitive foods over the nutrient balanced reimbursable meal, they risk over consuming nutrient deficient and energy dense choices.

Behavioral economics (BE) theory may help address the behavioral responses and poor food choices that can result from lunchroom environments. BE combines behavior models of psychology with decision models of economics to help highlight how biases in memory, thought processes, and perception can influence purchasing decisions (Just & Wansink, 2009). This approach can be used to determine triggers that lead to selection and consumption of foods. BE tactics can also be implemented at little to no cost. Thus, Cornell University developed the Smarter Lunchrooms Movement (SL) to equip schools with evidenced-based research tools to improve the food choices made by school aged children while considering cost, lunchroom environment, promotion of healthful eating behaviors, and sustainability (Smarterlunchroom.org). SL applies practical, cost-effective techniques focused on convenience, attractiveness, and normative nature of healthy

foods, to influence purchases. Thus, the SL incorporated behavioral economics into their design to influence and not restrict food choices.

SL may encourage students to make healthier choices without knowing it. A SL intervention study in New York schools showed that after the SL intervention, students were 13.4% more likely to choose a fruit and 23% more likely to take a vegetable (Hanks, Just, & Wansink, 2009). Research also suggests that there is a need to address competitive menu items by making them less convenient, attractive, and normal choices. Competitive and less healthy foods have shown to decrease the amount of fruit and vegetable consumption (Neumark-Sztainer et al, 2005). These studies demonstrate changing the school lunchroom environment can affect the food choices made by children during lunch. Changing the school lunchroom environment could be one of the first steps at preventing childhood obesity. Although SL intervention trials have been carried out in urban New York school systems, there has been a lack of evidence of a successful large-scale intervention in Ohio schools, particularly in rural areas. Thus, the purpose of this study was to develop and implement SL programming in Ohio schools (a feasibility trial).

Methods

Study Design. This study was a pre and post intervention trial to develop and implement Smarter Lunchrooms (SL) programming in Ohio to promote healthier food selection and lessen plate waste among children participating in the NSLP.

Target population and recruitment. The study used a convenience sample of 12 schools in Ohio. Food service directors from Ohio K-12 schools applied for an Ohio Department of Education's (ODE) Team Nutrition grant in March 2013. ODE selected 50 K-12 schools and assigned ~12 schools each to 4 universities who were recruited to conduct the research arm of this project. Universities contacted their assigned schools, introduced themselves, and began initial discussions. The Ohio State University research group was assigned a convenience sample of 12 schools that included 7 elementary schools, 3 middle schools, and 2 high schools.

Outcome measures. Trained research staff conducted cafeteria assessments and consulted with schools to develop an intervention work plan. The pre-intervention data collection consisted of an environmental assessment of SL best practices already in place. Data was collected using the Evaluation Matrix tool. Researchers also accumulated photographs of cafeteria, specifically: the exterior approaching lunchroom, the lunchroom, tray return areas, lunch lines, cash register, a la carte area, any signs or posters regarding nutrition and menus. The food service director (FSD) was consulted for

suggestions based on specific needs of the staff and this information was incorporated into the final individualized intervention plans tailored to each school. Intervention plans consisted of goals, BE strategies, budget, and evaluation plan. Schools implemented the intervention at scheduled start dates during the 2013-14 academic year. Schools were assessed using the same Evaluation Matrix post-intervention to document changes in SL practices. A fidelity checklist determined schools' adherence to intended intervention plans.

Intervention: Each intervention consisted of several SL strategies. These multi-component interventions were individualized to each school based on pre-intervention assessment. Each school implemented at least 5 strategies; some elementary schools included up to 7 strategies. A sample of these intervention components that were implemented includes the following: 1) increase number of locations that fruit is offered, 2) label fruit with creative and age-appropriate names, and 3) offer equal amounts of white and chocolate milk. The schools implemented the intervention on the first day following a weekend or spring break. The FSDs and their staff conducted the intervention for at least four consecutive weeks.

Tools: The Evaluation Matrix (Appendix A) was used to determine the level of SL best practices pre- and post-intervention. Researchers rated (scale of 0-5) the level of SL practices across five categories (Fruit, Vegetable, White Milk, Target Entrée, and Reimbursable Meal) for a possible total of 25 points. A Fidelity Checklist (Appendix B) was designed as a process evaluation technique, and allowed research staff to quantify the school's adherence to the intervention components that were to be implemented. Trained researchers completed process evaluations at a subset of schools weekly for three weeks each post-intervention. Fidelity checklists were tailored to each school's selected SL intervention strategies.

Statistical Analysis. Evaluation Matrix scores were averaged (mean $\pm$ SD) for each school pre- and post- intervention and differences were assessed using a paired t-test (significance set at $p<.05$). Data from the Fidelty Checklists were converted to a percentage (% adherence) for each intervention strategy across schools.

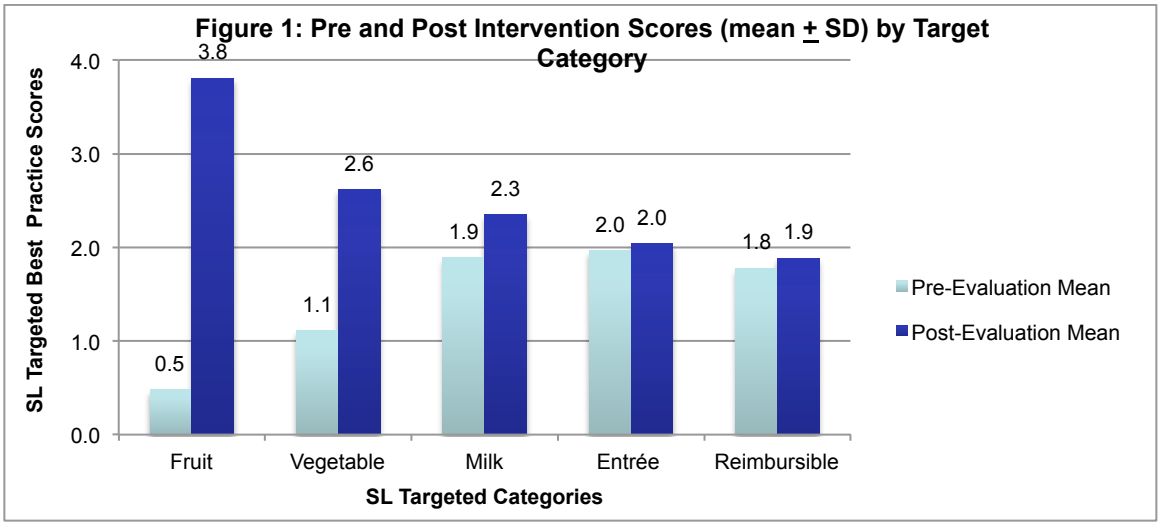
Results

Below is a demographic representation of each of the three school districts in Ohio that participated in the SL intervention (Table 1). Within each school districted there are a subset of schools, these schools are distinguished in appendix C (Table2).

Table 1: Demographics for participating school districts: Fiscal year 2013; district profile report

	Trimble	Meigs	Marion
Enrollment	860	1,733	4,168
Qualify for free and reduced (%)	66.0	65.4	99.3
Asian (%)	0.1	0.1	0.2
Hispanic (%)	0.0	0.2	5.1
Black, non-Hispanic (%)	0.6	1.0	6.5
White, non-Hispanic (%)	97.9	96.5	81.2
Multiracial (%)	1.3	1.8	7.0
Students with disabilities (%)	23.1	14.05%	18.9
Limited English proficiency (%)	0.1	0.0	1.0

SL best practice scores increased from 7.4±3.3 pre-intervention to 13.8±2.3 post-intervention ($p<.001$). All categories showed improvement post-intervention with the largest advancement in Fruit (+3.3 in mean score) and Vegetable (+1.5 in mean score) practices (Figure 1).



Process evaluation data showed 69% adherence overall. Compliance was lowest for SL strategies of increasing the number of locations fruit is offered (55%), labeling fruit (44%) and targeted entrée (17%) with creative, age-appropriate names, and offering equal amounts of white and chocolate milk (38%), (Table 2). The compliance for each school is provided in Appendix C (Table3).

Table 2: Level of Adherence to Program Implementation

Intervention Strategies	Compliance (%)

Increase number of locations that fruit is offered	55%
Label fruit with creative and age appropriate names	44%
Label targeted entrée with creative and age appropriate names	17%
Offer equal parts of white and chocolate milk	38%

Discussion

These results demonstrate SL programming was developed and implemented across Ohio schools with moderate implementation fidelity. The results of this study are similar to a SL intervention conducted in NY schools. Two NY schools conducted multi-component interventions focused on convenience, attractiveness, and normativeness. The results included an increase in fruit and vegetable consumption (Hanks, Just, & Wansink, 2009). The NY study did not conduct a process evaluation.

Future research is needed to evaluate factors related to fidelity of SL implementation and the development of effective tactics to improve fidelity. Friend et al, 2014 studied sustainability of a school-based physical activity program and discovered three ways to improve fidelity: 1) fit into the current school structure, 2) receive buy-in by teachers, and 3) require minimal additional funds or staff time. (Friend, Flattum, Simpson, Nederhoff, & Neumark-Sztainer, 2014). The SL interventions are simple, low-cost strategies that fit into the current lunchroom environment, however, some of the strategies used by SL require more physical space (e.g., increasing the number of locations fruit and vegetables are offered), which may be a problem for smaller schools with less room on their lunch line. In addition, some strategies (e.g., placement of white milk vs. flavored milk) increase staff time, as foods need to be restocked to maintain compliance with the selected strategy. This study used the pre-intervention assessment as an opportunity to receive buy-in from the FSD and foodservice staff. Working in consultation with the foodservice employees was important for selecting strategies that were possible and practical. This part of the process may have been important for building a sense of ownership and therefore motivation as well. In future studies, researchers should emphasize the need for FSDs to develop the buy-in from their foodservice staff (e.g., more frequent and transparent communication, reassignment of tasks during service) to evoke staff ownership of the interventions, and thus improving compliance.

There are several study limitations. Process evaluation was limited to a subset of schools and was conducted no more than one time a week. Increasing the frequency of fidelity measurements would provide a more accurate assessment of school adherence to SL programming. Also, the evaluation matrix was based on targets of the NSLP which made them great for recognizing areas needing improvement within the lunchrooms, but ratings are subjective, allowing for variance in scoring between researchers. Researchers

addressed this limitation by requiring evaluators to be trained to follow a standard assessment protocol.

In conclusion the SL movement is a feasible program to implement in Ohio schools. It is important to address childhood obesity early on, and because the NSLP is utilized nation wide and serves over 30 million students a day, this makes it an excellent target to reach as many children as possible. Targeting young children is an effective way to develop healthy behavior at an early age in order to prevent obesity. Behavior changes can still be made as an adult, meaning that incorporating SL practices into college level and professional environments may be beneficial to reducing obesity at any age.

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Appendices

Appendix A

Evaluation Matrix

	Fruit	Vegetables	White Milk	Targeted Entrée	Reimbursable
0	Fruit with peel is under sneeze shield in metal chaffing dish	Vegetables are difficult to identify/see on the lunch line	White milk is placed in the back of coolers, in disproportionate amount to flavored milks and cannot be seen/reached	No nutrient dense entrée is identified on the lunch line and no entrée is highlighted	Reimbursable meal is not identifiable/ by staff or students and is not highlighted
1	Fruit with a peel is under sneeze shield in an attractive bowl	Vegetables are moved to a well-lit area on the lunch line	White milk is easily reachable in one location where beverages are sold/displayed but less so to flavored milks	Nutrient dense entrée is identified by staff and has been placed first in at least one service line	Reimbursable meal is offered in at least two meal service lines/locations
2	Fruit with a peel is in an attractive bowl and in an easily reached location.	Vegetables have been assigned creative and age-appropriate names and are moved to a well-lit area on the lunch line	White milk is easily reachable in at least two locations where beverages are sold/displayed but, is disproportionate to flavored milks	Nutrient dense entrée is identified by staff, placed first in at least one service line and has been assigned a creative/ age-appropriate name	Reimbursable meal is offered in at least two meal service lines/locations and has at least two different meal combination options
3	Fruit with a peel is in an attractive bowl, in a well-lit and easily reached location on the lunch line	Creative and age-appropriate names are displayed next to assigned vegetables in a well-lit area on the lunch line	White milk is easily reachable in all locations where beverages are sold/displayed and looks proportionate to flavored milk	Nutrient dense entrée is identified by staff, placed first on each respective service line, is convenient to reach/see and is labeled with age appropriate/creative name	Reimbursable meal is offered in all meal service lines/locations and has multiple combination options and is labeled
4	Fruit with a peel is in an attractive bowl and in two well-lit and easily reached locations on the lunch line	Creative and age-appropriate names are displayed next to assigned vegetables in a well-lit area on the lunch line and on menu posters/boards in the cafeteria	White milk is easily reachable in all coolers where beverages are sold/displayed and represents at least 1/3 of all visible milk in the lunchroom	Nutrient dense entrée is identified by staff, placed first on each respective service line, is convenient to reach/see, labeled with age appropriate/ creative names and the names are placed on menu boards/posters in lunchroom	Reimbursable meal is offered in all lines/locations, has multiple combination options, is labeled and highlighted on menu boards/posters
5	Fruit with a peel is in an attractive bowl, in two or more well-lit and easily reached locations with one location being near the register.	Vegetables are displayed in at least two well-lit, easily accessible/highly trafficked areas and have creative and age appropriate names displayed next to them and on menu posters/boards	White milk is easily reachable in all coolers and some vending machines where beverages are sold/displayed , represents at least 1/3 of all visible milk in the lunchroom and is highlighted with posters/boards	Nutrient dense entrée is identified by staff, placed first on each respective service line, is convenient to reach/see, labeled with age-appropriate names and the names, menu board highlight targeted entrée and staff is verbally highlighting targeted entrée	Reimbursable meal is offered in all meal service lines/locations, has multiple combination options, is labeled and highlighted on menu boards/posters in lunchroom and verbally cued by service staff.

Appendix B

Sample of fidelity checklist:

Fidelity Checklist
School:
Name(s):

Date

Intervention	Implemented ? Y/N	Comments
Fruits are labeled with creative, age appropriate names (words or pictures)		
Vegetables are labeled with creative, age appropriate names (words or pictures)		
Entrees are labeled with creative, age appropriate names (words or pictures)		
Fruits are offered in baskets		
Vegetables are offered in baskets		
Increased number of locations fruit is offered		
Sign close to register area displays next day's menu		
Equal amounts of white and chocolate milk		
White milk is in front of the cooler		
Smarter lunchrooms stickers are passed out to children who make healthful decisions		
Lunchroom has been recently painted (ask staff if you are not sure)		
Other		

Appendix C

Table 3: Pre-Post SL Best Practice Scores and Levels of Adherence to Program Implementation by School

School	District	Pre-Intervention SL practices score	# of SL strategies in planned intervention	Post-Intervention SL practice scores	Difference Pre- to Post SL practice scores*	Compliance (%)
Harding HS	Marion	13.2	5	14.5	1.2	64%
Trimble HS	Trimble	5.5	5	9.5	4	no data
Meigs HS	Meigs	6	6	12.5	6.5	64%
Meigs MS	Meigs	7	7	7	0	56%
Grant MS	Marion	10	5	13	3	20%
Taft ES	Marion	8	7	12.5	4.5	20%
Mckinely ES	Marion	3.5	7	15	11.5	64%
Garfield ES	Marion	3.5	7	16.5	13	73%
Hayes ES	Marion	5	7	13	8	68%
Harrison ES	Marion	6	7	14	8	68%
George Washington ES	Marion	5.8	7	12	6.2	64%
Meigs ES	Meigs	10	6	10	0	50%

* $p < 0.001$, paired t-test